FACT SHEET
UNITED STATES AIR FORCE

Titan IVB Expendable Launch Vehicle

Titan IVB launch at Cape Canaveral
Photo courtesy Lockheed Martin Space Systems

The Air Force Titan IVB launch vehicle is the nation's largest, most powerful expendable space launch vehicle and provides access to space for the United States government's largest payloads. In 1989, a follow-on procurement to the existing Titan IVA space lift vehicle resulted in the Titan IVB model. The upgraded rocket incorporates significant technology advancements to decrease operational processing time and increase overall reliability. The Titan IVB is capable of placing 47,800 pounds into low-Earth orbit or more than 12,700 pounds into geosynchronous orbit - 22,300 miles above the Earth's equator.

The Titan IVB consists of two solid-propellant stage "0" motors, a liquid propellant two-stage core and a 16.7-foot-diameter payload fairing. Upgraded three-segment solid rocket motors increase the vehicle's payload capability by approximately 25 percent over the Titan IVA. During a Titan IV launch the strap-on solid rocket motors are fired first. When the solid propellant is almost depleted (approximately 130 seconds into flight), the first stage is fired and the solid motors are separated from the vehicle. The second stage and upper stage are fired as the previous stage is depleted of fuel and separated.

Heritage

The Titan family of launch vehicles was established in October 1955 when the Air Force awarded the Martin Company (today Lockheed Martin Astronautics) a contract to build a heavy-duty space system. It became known as the Titan I, the nation’s first two-stage, intercontinental ballistic missile (ICBM) and first underground silo-based ICBM. The Titan I rocket provided many structural and propulsion techniques that were later incorporated into the Titan II.

Martin Company and the Martin Marietta Corporation built more than 140 Titan ICBMs, once the vanguard of America's nuclear deterrent force, for the Air Force. Titan IIs were flown as space launch vehicles in NASA's Gemini manned space program in the mid-1960s. Deactivation of the Titan II ICBM system began in July 1982. The last missile was taken from its silo at Little Rock Air Force Base, Arkansas, on June 23, 1987. Years later, the Titan II evolved into the Titan III family and the Titan 34D. The larger Titan expendable space launch vehicle was originally developed as a backup for the space shuttle in the 1980s, but has become a mainstay for heavy payloads. The Titan IVB represents significant improvements from the Titan 34D and Titan IVA from which it evolved. The first Titan IVB flew February 23, 1997 from Cape Canaveral’s launch complex 40 carrying the Defense Support Program satellite designated Flight 18.

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The Titan IVB's core consists of an LR87 liquid-propellant rocket that features structurally independent tanks for its hypergolic fuel of Aerozine 50 (hydrazine and unsymmetrical dimethyl-hydrazine) and oxidizer (Nitrogen Tetroxide). This minimizes the hazard of the two mixing if a leak should develop in either tank. Additionally the engines' propellant can be stored in a launch-ready state for extended periods. The use of propellants stored at normal temperature and pressure eliminates delays and gives the Titan IVB the capability to meet critical launch windows. The second stage consists of an LR91 liquid propellant rocket engine attached to an airframe, like stage 1.

Titan IV launch vehicle core assemblies undergo construction. Photo courtesy Lockheed Martin

Operational Improvements

The Titan IVB uses a "clean vehicle" approach for delivering hardware to the launch sites. This method shifts production-oriented tasks, such as liquid rocket engine installation and electronic system installation, to the factory. When the rocket is shipped to the launch site it requires only check-out testing and a minimum of final processing.

Assembly and integration of the Solid Rocket Motor Upgrade occurs in the new Solid Motor Assembly and Readiness Facility at Cape Canaveral Air Station and the Solid Motor Processing Facility at Vandenberg Air Force Base, California.

Standard vehicle configuration

The Titan IVB common core design provides a standard mechanical and electrical configuration to the various upper stages and payloads. With this feature, all Titan IVB vehicles are identical up to the interface just below the payload fairing. The Titan IVB standard vehicle design allows hardware to be quickly reallocated to different missions as launch dates or national priorities are changed. It also eliminates the need for unique engineering and specialized processes for each individual core vehicle.

Solid Rocket Motor Upgrade (SRMU)

The new SRMU provides increased payload capacity and improved safety, reliability, and launch site operability, while reducing cost per pound of payload. The SRMU features a three-segment design. Light-weight graphite composite cases coupled with the use of high performance propellant results in a 25 percent increase in lift capability. The number of critical field joints has been reduced from eight on a Titan IVA to two on the Titan IVB, with each field joint having redundant seals. Five full-scale static test firings qualified the motor design in 1993.

A Titan 4A on the launch pad looks distinctly different than the upgraded and improved Titan IVB. Photo: Lockheed Martin.

Advanced avionics

Obsolete technology and unprocurable hardware necessitated upgrades to the Titan IV's electrical systems. The new systems on the Titan IVB were designed to improve overall reliability and maintainability. Guidance system technology advancements include ring laser gyros and a new computer that doubles data processing capability. The system is packaged in a single guidance control unit which weighs 40 pounds less than its Titan IVA equivalent. By using modern parts and manufacturing techniques, the recurring cost of the guidance system has been decreased by more than 50 percent. A new data distribution and acquisition system provides higher data rates and more accurate telemetry for systems evaluation.

Range safety improvements

The Titan IVB procurement also provided an opportunity to bring the Flight Termination System *(FTS)* into a configuration that meets the latest range safety requirements. The Titan IVB automatic and command destruct systems are completely redundant. The system was streamlined by combining multiple functions in a new flight termination controller.

Programmable Aerospace Ground Equipment *(PAGE)*

Titan IVB pre-launch vehicle check-out and launch countdown are controlled by a new automated ground processing system, called Programmable Aerospace Ground Equipment *(PAGE)*. During the countdown, PAGE controls vehicle processing, continuously monitoring vehicle systems status and trends. In the event of a vehicle or ground system malfunction, PAGE can hold or abort the launch process up to ignition of the solid rocket motors. The new PAGE system will eliminate obsolete hardware and resolve maintenance problems with the existing system.

Data for the Titan IV-B

		CHARACTERISTICS
Stage 0 *(SRMU)*	Length	112.4 feet
	Diameter	10.5 feet
	Motor Thrust	1.7 million lb. per motor
	Weight	777,000 pounds (approximately)
	Contractor	Alliant Techsystems
First Stage	Length	86.5 feet
	Diameter	10 feet
	Thrust	551,200 lbs. *(full duration average)*
	Contractor	Lockheed Martin Astronautics
Second Stage	Length	32.7 feet *(bottom of engine nozzle to top of forward skirt)*
	Diameter	10 feet
	Thrust	106,150 lbs. *(full duration average)*
	Contractor	Lockheed Martin Astronautics
Centaur Upper Stage	Length	29.4 feet
	Diameter	170 inches
	Thrust	33,000 lbs.
	Contractor	Lockheed Martin Astronautics
Inertial Upper Stage	Length	17 feet
	Diameter	114 inches
	Thrust	41,700 lbs./17,200 lbs. *(average thrust)*
	Contractor	Boeing Defense and Space Group